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Management of Coexisting Coronary Artery and Asymptomatic Carotid Artery Disease: Report of a Series of Patients Treated with Coronary Bypass Alone

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Background: *a retrospective chart review of 94 patients with asymptomatic high-grade carotid stenosis undergoing coronary bypass (and valve replacement in some cases) was performed to determine whether significant carotid lesions can be safely ignored in patients undergoing cardiac surgical procedures. These operations were performed during a 2-year period.*
Patients and methods: *there were 55 men and 39 women, with an age range of 37–89 years. Seventy-one patients had unilateral high-grade carotid stenosis, 17 patients had bilateral high-grade lesions, and six patients had unilateral high-grade stenosis and contralateral occlusion. Associated medical problems were recorded and short-term follow-up was obtained.*
Results: *there was one perioperative stroke and no deaths in this group of patients.*
Conclusions: *although these data indicate that high-grade carotid stenoses may be safely ignored during cardiac surgical procedures, a multicentre prospective randomised trial is needed to determine the appropriate treatment of the patient with coexisting carotid and coronary artery disease.*

Key Words: Carotid endarterectomy; Coronary bypass.

Introduction

The question of whether to perform prophylactic carotid endarterectomy in the patient with high-grade asymptomatic carotid stenosis undergoing coronary bypass remains unanswered. Some groups have advocated performing both procedures under the same anaesthetic,[1–10] while others have endorsed a staged approach or completely ignoring carotid lesions.[11–18] Advocates of a staged approach perform carotid endarterectomy several days prior to coronary bypass, or several days to weeks following cardiac surgery.

The rationale for performing carotid endarterectomy several days prior to coronary bypass, or the staged approach, is to decrease the risk of stroke in the cardiac procedure and eliminate the need for a longer and more stressful combined procedure.[16] Increased cardiac morbidity and mortality resulting from the endarterectomy may offset any potential benefits of this approach.

The reversed staged approach, in which carotid endarterectomy is performed a short time after coronary bypass, is used by those who believe that cardiac morbidity and mortality outweigh the risks of neurologic complications.[16]

If the combined approach can be done safely, its advantages are obvious. A second surgical procedure and hospital stay may be eliminated, with significant cost reduction as well. Long-term stroke-free survival may also be significantly improved.

For many years, the combined approach to this problem was favoured at North Shore University Hospital. In 1995, a significant increase in morbidity from simultaneous carotid endarterectomy and coronary bypass was noted, prompting a policy of ignoring high-grade asymptomatic carotid lesions prior to cardiac surgery. The results of that 2-year approach and a review of the literature are reported herein.

Patients and Methods

All patients considered for cardiac surgery undergo a preoperative carotid duplex scan, at North Shore University Hospital. Between December 1995 and January 1997, 1106 duplex scans were performed in

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Table 1. Associated medical problems in patients with high-grade asymptomatic carotid stenosis undergoing cardiac surgery.

Medical problem	No. patients (%)
Myocardial infarction	42 (45)
Stroke	7 (7)
Hypertension	71 (76)
COPD	38 (40)
PVD	13 (14)
Diabetes	23 (24)
Dialysis	1 (1)
Smoking	7 (7)

COPD = chronic obstructive pulmonary disease, PVD = peripheral vascular disease.

these patients. A retrospective review of their charts was undertaken. All scans were performed with an ATL (Bothell, WA, USA) duplex scanner in a laboratory accredited by the Intersocietal Commission for the Accreditation of Vascular Laboratories (IACVL). A high-grade stenosis (80–99%) was diagnosed when the peak systolic blood flow velocity was 250 cm/s or greater, and the distal internal carotid artery blood flow velocity was at least four times greater than the velocity in the distal common carotid artery.

Of the 1106 patients scanned, 1023 underwent coronary artery bypass alone, and 83 underwent coronary bypass and valve replacement. Coronary bypass was performed using ascending aortic cannulation and single-stage right atrial cannulation. Moderate hypothermia and blood cardioplegia were employed routinely. Distal coronary anastomoses were performed with a single aortic cross-clamp; proximal anastomoses were accomplished with partial aortic occlusion. A mean pump pressure of 70 mmHg or greater was maintained throughout cardiac-pulmonary bypass. Anaesthetic management of patients undergoing a combined procedure, or coronary bypass only was identical.

Results

Of the 1106 patients undergoing preoperative carotid duplex scans, 94 (8.5%) had at least one high-grade internal carotid artery stenosis. Seventy-one (6.4%) had unilateral severe carotid stenosis, 17 (1.5%) had bilateral severe carotid stenosis and six (0.5%) had unilateral high-grade stenosis with contralateral carotid occlusion.

There were 55 men with a mean age of 68 years and a range of 58–89 years. There were 39 women with a mean age of 69 years and a range of 37–83 years. Associated medical problems in these patients are outlined in Table 1. Eighty-five patients underwent coronary bypass alone; nine patients also had replacement of a valve. The mean aortic clamp time was 55 min with a range of 17–171 min.

Independent neurological examinations were performed on all patients postoperatively by a vascular surgeon, a cardiac surgeon and an intensive care physician. Only one patient had a neurological deficit, following cardiac surgery. He was 87 years old and had a preoperative history of congestive heart failure, left ventricular hypertrophy, prior myocardial infarction and a unilateral high-grade carotid stenosis. He underwent a single coronary artery bypass with aortic valve replacement and suffered a postoperative stroke in the hemisphere contralateral to the carotid stenosis.

In the group of patients undergoing coronary bypass alone, the incidence of neurological deficits was 1.1%.

The average length of stay was 6 days, with a range of 4–62 days. No new neurological deficits occurred during this period or during follow-up. Follow-up of all patients was obtained, ranging from 1 to 6 months; the mean follow-up was 2.3 months.

Discussion

The incidence of stroke following cardiac surgery ranges from 0.7 to 5.2%.[19] Strokes are caused by atherosclerosis of the ascending aorta, hypotension, hypertension, prolonged pump time and microembolisation.[20,21] Carotid bifurcation stenosis has also been shown to increase the risk of stroke in patients undergoing cardiac surgery.[13,22]

New neurological deficits following cardiac surgery do not always occur ipsilateral to a significant carotid stenosis. This is because of the multifactoral aetiology of adverse cerebral outcomes following coronary bypass. Adverse events are more likely to occur in the presence of proximal aortic atherosclerosis, a history of neurologic disease (suggesting pathological cerebrovascular condition) and older age (greater than 70).[24]

The advent of carotid duplex scanning has made preoperative screening of cardiac patients easy. A dilemma arises, however, when an asymptomatic carotid stenosis is detected because data can be found to support a staged, reversed staged, or combined approach.

With demonstration by the Asymptomatic Carotid Atherosclerosis Study (ACAS) that surgery is beneficial in long-term outcome for asymptomatic lesions greater than 60%,[23] and with demonstration of such lesions in up to 15% of patients undergoing coronary bypass, the proper role of combined carotid endarterectomy and coronary bypass needs precise definition.

Table 2. Reports favouring combined carotid endarterectomy and coronary bypass.

Authors	No. patients	Mortality	Stroke	Follow-up
Cambria *et al.*[1]	71	2.8%	4.2	N/A
Pome et al.[2]	52	0%	5.7%	67% 5 year stroke-free
Rizzo *et al.*[3]	127	5.5%	5.5%	97% 5 year stroke-free
Vermeulen *et al.*[4]	230	3.5%	4.35%	72% 5 year stroke-free
Kaul *et al.*[5]	175	3.42%	4%	82% 12 year stroke-free
Chang *et al.*[6]	189	2%	1%	N/A
Halpin *et al.*[7]	133	0.8%	2.3%	N/A
Akins *et al.*[8]	200	3.5%	3%	92% 10 year stroke-free
Daily *et al.*[9]	100	4%	0%	N/A
Hines *et al.*[10]	53	1.9%	0%	N/A

N/A = not available.

Table 3. Reports discouraging combined carotid endarterectomy and coronary bypass.

Authors	No. patients	CAB + CEA	Mortality	Stroke
Barnes *et al.*[11]	41	No CEA	0%	2.4%
Ivey *et al.*[12]	?	No CEA	?	?
Brener *et al.*[13]	57	+CEA	10.5%	8.8%
Perler *et al.*[14]	63	+CEA	11%	4.8%
Schultz *et al.*[15]	47	No CEA	0%	6%
Hertzer *et al.*[16]	71 (unilateral)	+CEA	4.2%	2.8%
	99 (bilateral)	+CEA	6.1%	7.1%
Coyle *et al.*[17]	65	+CEA	10.8%	15.4%
Mackey *et al.*[18]	100	+CEA	8%	9%
Safa *et al.*	94	no CEA	0%	1.1%

CAB, coronary artery bypass; CEA, carotid endarterectomy; ±, with or without; +CEA, combined carotid endarterectomy and coronary bypass; unilateral, unilateral carotid stenosis; bilateral, bilateral carotid stenosis.

A review of 10 papers written within the last decade appears in Table 2. These series number from 52 to 230 patients and they all demonstrate the safety with which the combined procedure may be performed. The papers are inconsistent, however, with respect to criteria for carotid endarterectomy, percentage of symptomatic versus asymptomatic carotid lesions, distribution of coronary and carotid artery disease, and availability of long-term cardiac and neurological event-free survival data.

A review of eight papers cautioning against the combined procedure appears in Table 3. These number from 41 to 100 patients and suffer from the same deficiencies as those in Table 2. Additional difficulty in comparing the reports within this group is encountered because some authors disparage the combined procedure based upon their own poor results with it, while others advise against it based upon the good results obtained with a policy of ignoring carotid lesions. In all of these papers, morbidity and mortality rates quoted for the combined procedure as well as single operations are variable, and highly dependent upon patient selection criteria. Differences in operative techniques and anaesthetic management, and statistical variability may also account for the diversity in these results.

Our data indicate that high-grade asymptomatic carotid stenoses may be safely ignored in patients undergoing cardiac surgery. The carotid lesion may be addressed days to weeks after the cardiac procedure. Our report suffers, however, from inadequate long-term follow-up of these patients.

Rather than conclude that the combined approach is unwarranted, we believe that the abundance of conflicting data points to the need for a multicentre prospective randomised trial. We are currently discussing the feasibility of such a trial with other institutions and are in the process of determining the number of patients such a study would require. Staged and simultaneous carotid and coronary operations need to be compared. Further stratification of patients by distribution of coronary artery disease (single left anterior descending, double vessel, triple vessel) and carotid artery disease (unilateral, bilateral) would be necessary. The presence of carotid and coronary symptoms must also be noted.

Study end points should include operative mortality, stroke, and myocardial infarction. Long-term strokes and transient ischaemic attacks, myocardial infarctions, carotid and coronary reoperations and deaths must also be tracked.

Only a multicentre prospective randomised trial of this nature will finally determine the appropriate management of the patient with coexisting carotid and coronary artery disease.

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